Catalogue of American Amphibians and Reptiles.

MARTOF, BERNARD S. 1973. *Siren intermedia.*

Siren intermedia Le Conte
Lesser siren

Siren intermedia Le Conte (*In* Harlan, 1827:322). Scant original description was by Harlan, but accredited to John Eatton "Le Conte, manuscript notes." Le Conte's description (1828:133) appeared later. Stejneger and Barbour, 1933 and 1939, and Schmidt, 1953, erroneously refer to Le Conte, 1827. Type locality, "southern states" restricted to Riceborough, Liberty County, Georgia (Harper, 1935). No type specimens designated.

• CONTENT. Three subspecies have been described: *intermedia, nettingi*, and *texana*.

• DEFINITION. See generic account. This large, eel-like salamander varies in maximum total length from 380 mm in the southeastern states, to 502 mm in the Mississippi Valley and to 686 mm in the Rio Grande Valley. Males attain larger size than females and the masseter region of the head is enlarged. Costal grooves range from 31 to 38; specimens from the southeastern states average 32.75; Mississippi Valley, 34.97; and Rio Grande Valley, 37.22. Digits rank 4-1-3-2 in order of increasing length, often 4-1-2-3 or 4-3-1-2. Rarely specimens have 3 or even 5 digits (Goin, 1957). Digital cornifications may be absent in some large adults. The vomerine teeth are in 2 divergent patches.

In early spring each adult female lays a clump of about 200 eggs in a 2-inch pocket in the bottom of a pond (Noble and Marshall, 1932; Bishop, 1943; Collette and Gehlbach, 1961; Hubbs, 1962). The ova average about 3 mm in diameter. About 40% of the surface of each egg is pigmented (brownish gray). Details of embryonic development are lacking, but the gross anatomy of late embryos and hatchlings is well known (Noble and Marshall, 1932). Hatchlings are about 11 mm in total length and have a small head, a long body, a very short tail, and a conspicuously broad and long dorsal fin. The young soon develop a distinctive color pattern. Meanwhile the head broadens, the tail elongates, and the dorsal fin begins to decrease in size. The tail comprises 19 to 25% of the total length of hatchlings and 28 to 40% of that of adults. The dorsal part of the tail fin extends anterior to the anus in juveniles but is entirely postanal in adults. In 6 weeks a 30-mm larva may transform and grow to 111 mm (Smith, 1961).

The young are boldly marked. Hatchlings have a narrow, light, middorsal stripe extending from the neck region to the tip of the tail, a longitudinal light streak on the side of the body, and another along the ventrolateral region. Light markings also occur on the head: a broad band on the snout, a longitudinal marking over each eye, and a transoccipital band. These light areas are early invaded by lipophores and become orange or reddish (Smith, 1961; Neill, 1949) or even yellowish (Noble and Marshall, 1932). The light markings gradually disappear but those on the head are more persistent, sometimes lasting into adult life as does the lateral stripe in some Texas specimens. The broad band on the snout is the most persistent and diagnostic marking. Older juveniles are olive-green with tiny brown spots.

In adults the dorsum may be dark brown, black, dark olive, olive-green or grayish blue. Dark individuals lack markings but lighter ones have scattered black or brown dots. The venter is slightly lighter than the dorsum; white to yellow flecks may occur on the sides of the body.

Sexual maturity is reached in two years; females then average 150 mm in snout-vent length and males 180 mm. Sexual dimorphism in size is often conspicuous. *E.g.*, in a large collection from Texas (Davis and Knapp, 1953), the adult males averaged larger than the largest female (215 mm snout-vent and 321 mm total length). The largest male was 313 mm snout-vent and 465 mm total length.

• DIAGNOSIS. See generic account for characteristics distinguishing *Siren* from other salamanders. *S. intermedia* differs from *S. lacertina* by having a much wider distribution. They occupy the same general types of habitat; however in the area of sympatry, *S. intermedia* does not occur as abundantly in streams and rivers. Specimens of *S. intermedia* are generally much smaller than *S. lacertina*, have a more slender body and fewer costal grooves. Western specimens have a grayer dorsum with smaller dark spots and the chin, axillae, and undersurfaces of the limbs are lightly pigmented.

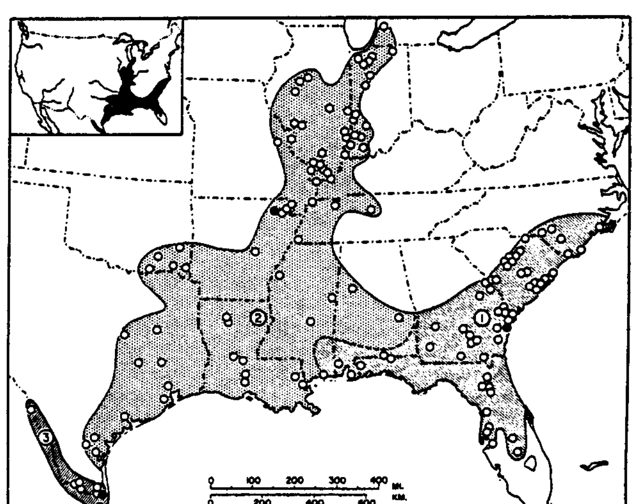
The eggs of *S. intermedia* are about one mm smaller in diameter, have thinner capsules, and tend to be laid in clumps (Hubbs, 1962) rather than scattered singly or in small groups. The average complement of eggs is about 200 for *S. intermedia* and slightly over 500 for *S. lacertina*. Juveniles have a relatively broader head than occurs in *S. lacertina* and are differently colored. The light markings are more reddish; furthermore, that on the snout is very broad and conspicuous.

• ILLUSTRATIONS. A color photograph is presented in Cochran and Goin, 1970 (plate 1) and in Barbour, 1971 (plate I). Several good black and white photographs are available: Adults, dorsal view—Bishop (1943:462); Carr and Goin (1955: plate 35); Conant (1958:266); and Smith (1961:64). Eggs—Noble and Marshall (1932:2). Fine line drawings include: Adult showing the form of the body, the gills, and the limbs—Le Conte (1828:fig. 1a); Bishop (1943:456). Male urogenital system—Willett (1965:12). Eggs—Salthe (1963:163). Hatchlings, lateral views showing markings and details of external morphology—Noble and Marshall (1932:6 and 11); Neill (1949:20). Young, lateral views—Noble and Marshall (1932: 8).

• DISTRIBUTION. This is the most widespread of all sirenids. It occurs in the Coastal Plain from southeastern North Carolina to southern Florida, westward in the Gulf states to the lower Rio Grande Valley and adjacent Mexico, and northward in the Mississippi Valley through Illinois, Indiana, and southwestern Michigan. This species inhabits shallow, warm, quiet, sometimes turbid waters where vegetation abounds: swamps, ditches, sloughs, ponds, lakes, and to a lesser extent rivers and streams.

• FOSSIL RECORD. None.

• PERTINENT LITERATURE. The most comprehensive treatment of the biology is by Noble and Marshall (1932). Other fine general accounts are Bishop (1943); Goin (1957); Smith (1961); and Freytag (1965). General accounts of geographic distribution include Noble and Marshall (1932); Goin (1942, 1957); Bishop (1943); and Conant (1958). More localized accounts include: Southeastern U. S.—Harper (1935); Chermock (1952); Carr and Goin (1955); Freeman (1955); Collette and Gehlbach (1961); Caldwell and Howell (1966); Duellman and Schwartz (1958); Funderberg and Lee (1967); Sanderson and Lee (1970). Mississippi Valley—Viosca (1925); Parker (1947); Blair (1951); Bragg (1952); Bonn and McCarley (1953); Liner (1954); Gentry (1955); Dowling (1957); Smith and Minton (1957); Smith (1961); Williams (1961); Walker (1963); Klimstra and Hutchison (1965); Fouquette and Delahoussaye (1966); Altig (1967); Bennett and Taylor (1968); Minton (1973); Texas—Smith and



MAP. The solid circles mark the designated type-localities; open circles indicate other records.

Buechner (1947); Goin (1957); Olson (1967); Raun and Gehlbach (1972). A comprehensive account of food and feeding habits is provided by Scroggin and Davis (1956), and by Altig (1967); other useful references include Hurter (1911); Dunn (1924); Cagle and Smith (1939); Carr (1940); Davis and Knapp (1953); Collette and Gehlbach (1961). For information on predation see Buck (1946); Neill (1954); Walker (1963); acoustic behavior, Gehlbach and Walker (1970); growth and size classes, Davis and Knapp (1953) and Bennett and Taylor (1968); winter aggregation, Cagle and Smith (1939); burrowing, Cochrum (1941); skin and cocoon, Reno *et al.* (1972); aestivation, Gehlbach *et al.* (1973). See generic account regarding collecting. For a description of eggs, egg capsules, hatchlings (growth, markings and development), and comparisons with *S. lactertina* see Noble and Marshall (1932). The ontogeny of cranial bones is described by Altig (1965); the lungs and distribution of respiratory capillaries by Czopek (1962a, 1962b); the chromosomes by Kezer *et al.* (1965); and the lateral line system by Reno and Mittleton (1973).

1. *Siren intermedia intermedia* Le Conte Eastern lesser siren

Siren intermedia intermedia Goin, 1942:211. Subspecific status proposed.

• Definition and Diagnosis. Members of this taxon have the fewest costal grooves (31 to 35, average 32.75) and are the smallest (maximum total length 380 mm). The dorsum is black, or brown sprinkled with minute black dots. This subspecies inhabits the southern Coastal Plain from North Carolina to southeastern Mississippi. It intergrades with *S. i. nettingi* along the Pearl River system of southwestern Mississippi and southeastern Louisiana (Boyd and Vickers, 1963).

2. *Siren intermedia nettingi* Goin Western lesser siren

Siren intermedia nettingi Goin, 1942:211. Type locality, "Imboden, Lawrence County, Arkansas." Holotype, Carnegie Museum No. 7850, adult female, collected in May, 1928 by Bryon C. Marshall.

• Definition and Diagnosis. This subspecies is intermediate in number of costal grooves (33 to 37, average 34.97) and in body size (maximum total length 502 mm). The dorsum is brown, black, olive or bluish gray often with scattered tiny black flecks or spots. The venter is lighter than the dorsum and often marked with light flecks. This siren inhabits central Alabama, the Mississippi Valley north to Michigan, and south to the central Gulf Coast region of Texas.

3. *Siren intermedia texana* Goin Rio Grande siren

Siren intermedia texana Goin, 1957:37. Type locality, "Texas, Cameron County, seven miles north of Brownsville." Holotype, Texas Cooperative Wildlife Collection (College Station, Texas) No. 10,567, adult female, collected June 7, 1953 by W. P. Kerr.

• Definition and Diagnosis. This subspecies has 36 to 38 (average 37.22) costal grooves and attains a maximum total length of 686 mm. The dorsum varies from dark gray with no discernible pattern to light or brownish gray with numerous tiny, dark flecks or spots. The venter is lighter, especially under the jaws, limbs, gills and vent. The many costal grooves and the large size distinguish this subspecies from other *S. intermedia.* It differs from *S. lacertina* by having a pointed tail, an average of one less costal groove and smaller dark spots on the dorsum. It is restricted to the lower Rio Grande Valley and to northern Tamaulipas, Mexico. In Jim Wells and Kleberg counties (Goin, 1957) and north to San Patricio and Aransas counties (Raun and Gehlbach, 1972), Texas, it intergrades with *S. i. nettingi.*

• Etymology. The name *intermedia* (Latin *inter*, among, between and *medius*, mid or middle) refers to its intermediate size, smaller than *S. lacertina* but larger than *Pseudobranchus striatus*; *nettingi* is a patrynym for M. Graham Netting; and *texana* refers to its geographic restriction to Texas and a small part of adjacent Mexico.

Literature Cited

Altig, Ronald. 1965. Ontogeny of osseous cranial elements of *Siren intermedia.* J. Ohio Herpetological Soc. 5(2): 61–62.

— 1967. Food of *Siren intermedia nettingi* in a spring-fed swamp in southern Illinois. Amer. Midland Nat. 77(1): 239–241.

Barbour, Roger W. 1971. Amphibians and reptiles of Kentucky. Univ. of Kentucky Press, Lexington. x + 334 p.

Bennett, Charles and R. John Taylor. 1968. Notes on the lesser siren, *Siren intermedia* (Urodela). Southwest. Nat. 13(4):455–457.

Bishop, Sherman C. 1943. Handbook of salamanders: the salamanders of the United States, of Canada, and of Lower California. Comstock Publ. Co., Ithaca, New York. xiv + 555 p.

Blair, Albert P. 1951. Note on Oklahoma salamanders. Copeia 1951(2):178.

Bonn, E. W. and W. H. McCarley. 1953. The amphibians and reptiles of the Lake Texoma area. Texas J. Sci. 5: 465–471.

Boyd, Claude E. and David H. Vickers. 1963. Distribution of some Mississippi amphibians and reptiles. Herpetologica 19(3):202–205.

Bragg, Arthur N. 1952. Amphibians of McCurtain County, Oklahoma. Wasmann J. Biol. 10:241–250.

Buck, D. Homer. 1946. Food of *Farancia abacura* in Texas. Herpetologica 3(4):111.

Cagle, Fred R. and Philip E. Smith. 1939. A winter aggregation of *Siren intermedia* and *Triturus viridescens.* Copeia 1939(4):232–233.

Caldwell, Richard D. and William M. Howell. 1966. *Siren intermedia nettingi* from Alabama. Herpetologica 22(4): 310–311.

Carr, Archie Fairly, Jr. 1940. A contribution to the herpetology of Florida. Univ. Florida Publ. 3(1):1–118.

— and Coleman J. Goin. 1955. Guide to the reptiles, amphibians, and freshwater fishes of Florida. Univ. Florida Press, Gainesville. ix + 341 p.

Chermock, Ralph L. 1952. A key to the amphibians and reptiles of Alabama. Geol. Surv. Alabama, Mus. Paper (33):1–88.

Cochran, Doris M. and Coleman J. Goin. 1970. The new field book of reptiles and amphibians. G. P. Putnam's Sons, New York. xxii + 359 p.

Cockrum, Lendell. 1941. Notes on *Siren intermedia.* Copeia 1941(4):265.

Collette, Bruce B. and Frederick R. Gehlbach. 1961. The salamander *Siren intermedia intermedia* LeConte in North Carolina. Herpetologica 17(3):203–204.

Conant, Roger. 1958. A field guide to reptiles and amphibians of the United States and Canada east of the 100th meridian. Houghton-Mifflin Co., Boston. xv + 366 p.

Czopek, Juliusz. 1962a. Vascularization of respiratory surfaces in some Caudata. Copeia 1962(3):576–587.

— 1962b. Smooth muscles in the lungs of some urodeles. Nature 193:798.

Davis, William B. and Frank T. Knapp. 1953. Notes on the salamander *Siren intermedia.* Copeia 1953(2):119–121.

Dowling, Herndon G. 1957. Amphibians and reptiles in Arkansas. Occ. Pap. Univ. Arkansas Mus. 3:1–51.

Duellman, William E. and Albert Schwartz. 1958. Amphibians and reptiles of southern Florida. Bull. Florida State Mus. 3(5):181–324.

Dunn, Emmett R. 1924. *Siren,* a herbivorous salamander? Science 59(1519):145.

Fouquette, Martin J., Jr. and A. J. Delahoussaye. 1966. Noteworthy herpetological records from Louisiana. Southwest. Nat. 11(1):137–139.

Freeman, Harry W. 1955. An ecological study of the land plants and cold-blooded vertebrates of the Savannah River Project area. Part V. The amphibians and reptiles of the Savannah River Project area. South Carolina Univ. Pub. Biol. 1(4):227–238.

Freytag, Günther E. 1965. Armmolche. Die Aquarien- und Terrarien Zeitschrift 18(12):372–375.

Funderburg, John B. and David S. Lee. 1967. Distribution of the lesser siren, *Siren intermedia* in central Florida. Herpetologica 23(1):65.

Gehlbach, Frederick R. and Braz Walker. 1970. Acoustic behavior of the aquatic salamander *Siren intermedia.* Bioscience 20(20):1107–1108.

Gehlbach, Frederick R., Roxanne Gordon and Judy B. Neill. 1973. Aestivation of the salamander, *Siren intermedia.* Amer. Midland Nat. (in press).

Gentry, Glen. 1955. An annotated checklist of the amphibians and reptiles of Tennessee. J. Tennessee Acad. Sci. 30:168–176.

Goin, Coleman J. 1942. Description of a new race of *Siren intermedia* Le Conte. Annals Carnegie Mus. 29:211–217.

— 1957. Description of a new salamander of the genus *Siren* from the Rio Grande. Herpetologica 13(1):37–42.

Harlan, Richard. 1827. Genera of North American Reptilia, and a synopsis of the species. J. Acad. Nat. Sci. Philadelphia 5(2):317–372.

Harper, Francis. 1935. Records of amphibians in the southeastern states. Amer. Midland Nat. 16(3):275–310.

Hubbs, Clark. 1962. Effects of a hurricane on the fish fauna of a coastal pool and drainage ditch. Texas J. Sci. 14: 289–296.

Hurter, Julius, Sr. 1911. Herpetology of Missouri. Trans. Acad. Sci. St. Louis 20(5):59–274.

Kezer, James, Seto Takeshi and Charles M. Pomerat. 1965. Cytological evidence against parallel evolution of *Necturus* and *Proteus*. Amer. Nat. 99:153–158.

Klimstra, Willard D. and M. A. Hutchison. 1965. A collection of amphibians and reptiles in southern Illinois. Trans. Illinois Acad. Sci. 58:151–156.

Le Conte, John E. 1828. Description of a new species of *Siren*. Annals Lyceum Nat. Hist. New York 2:133–134.

Liner, E. A. 1954. The herpetofauna of Lafayette, Terrebonne and Vermilion parishes, Louisiana. Proc. Louisiana Acad. Sci. 17:65–85.

Minton, Sherman A., Jr. 1973. Herpetology of Indiana. Indiana Acad. Sci. Monogr. (3):1–346.

Neill, Wilfred T. 1949. Juveniles of *Siren lacertina* and *S. i. intermedia*. Herpetologica 5(1):19–20.

— 1954. Ranges and taxonomic allocations of amphibians and reptiles in the southeastern United States. Publ. Res. Div. Ross Allen's Rept. Inst. 1(7):75–96.

Noble, G. Kingsley and Bryon C. Marshall. 1932. The validity of *Siren intermedia* LeConte, with observations on its life history. Amer. Mus. Novitates 532:1–17.

Olson, R. Earl. 1967. Peripheral range extensions and some new records of Texas amphibians and reptiles. Texas J. Sci. 19(1):99–106.

Parker, Malcom V. 1947. Notes on the herpetology of Clay and Greene counties, Arkansas. Proc. Arkansas Acad. Sci. 2:15–30.

Raun, Gerald G., and Frederick R. Gehlbach. 1972. Amphibians and reptiles in Texas: taxonomic synopsis, bibliography, and county distribution maps. Dallas Mus. Nat. Hist. Bull. 2, 66 p. + 140 maps.

Reno, Harley W., Frederick R. Gehlbach and Robert A. Turner. 1972. Skin and aestivational cocoon of the aquatic amphibian, *Siren intermedia.* Copeia 1972(4): 625–631.

Reno, Harley W., and H. Hudson Mittleton, III. 1973. Lateral-line system of *Siren intermedia* Le Conte (Amphibia: Sirenidae), during aquatic activity and aestivation. Acta Zool. 54(1):21–29.

Salthe, Stanley N. 1963. The egg capsules in the Amphibia. J. Morph. 113:161–171.

Sanderson, Roger A. and David S. Lee. 1970. Another lesser siren from central Florida. Bull. Maryland Herpetol. Soc. 6(1):7–8.

Schmidt, Karl P. 1953. A check list of North American amphibians and reptiles. 6th Ed. Amer. Soc. Ichthyol. and Herpetol. viii + 280 p.

Scroggin, John B. and William B. Davis. 1956. Food habits of the Texas dwarf siren. Herpetologica 12(3):231–237.

Smith, Hobart M. and H. K. Buechner. 1947. The influence of the Balcones Escarpment on the distribution of amphibians and reptiles in Texas. Bull. Chicago Acad. Sci. 8:1–16.

Smith, Philip W. 1961. The amphibians and reptiles of Illinois. Illinois Nat. Hist. Survey Bull. 28(1):1–298.

— and Sherman A. Minton, Jr. 1957. A distributional summary of the herpetofauna of Indiana and Illinois. Amer. Midland Nat. 58(2):341–351.

Stejneger, Leonhard and Thomas Barbour. 1933. A check list of North American amphibians and reptiles. 3rd Ed. Harvard Univ. Press, Cambridge, Massachusetts. xiv + 185 p.

— 1939. *Idem*, 4th Ed. xvi + 207 p.

Viosca, Percy, Jr. 1925. A terrestrial form of *Siren lacertina*. Copeia 136:102–104.

Walker, J. Martin. 1963. Amphibians and reptiles of Jackson Parish, Louisiana. Louisiana Acad. Sci. 26:91–101.

Willett, Judith Ann. 1965. The male urogenital system in the Sirenidae. J. Tennessee Acad. Sci. 40(1):9–17.

Williams, John E. 1961. The western lesser siren in Michigan. Copeia 1961(3):355.

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